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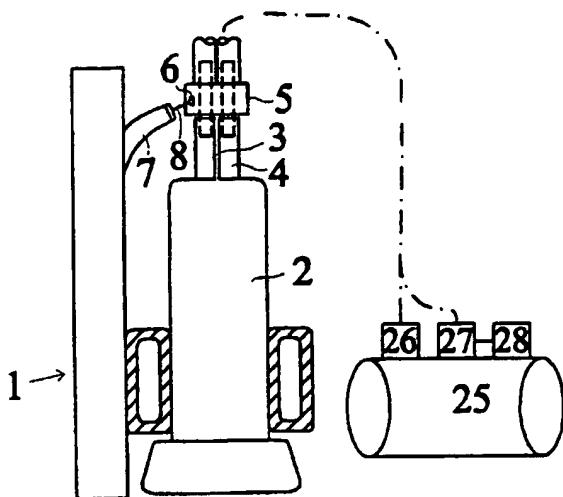
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MILKING MACHINE AND METHOD OF MILKING



(57) Abstract: A milking machine including a milk tank (25), a pulsator (26) and at least one teatcup (2) which is connected over a suction hose (3) to a suction pump (28), wherein at least one aperture (6) is arranged in the suction path for admitting outside air into the region of the interface between the teatcup (2) and the suction hose (3). The machine is distinguished in that a cleaning device (7; 9; 10) is arranged to provide fluid flow for cleaning the aperture (6) from dirt etc. between milking sequences, or alternatively in that a gas supply conduit (18) is connected to the aperture (6) for supplying pressurized gas into said region during the milking sequences. The invention also includes corresponding methods.

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MILKING MACHINE AND METHOD OF MILKING

FIELD OF THE INVENTION

This invention concerns a milking machine according to the
5 preamble of claim 1 and a method according to the preamble of
claim 12. In a second aspect it also concerns a milking
machine according to the preamble of claim 19 and a method
according to the preamble of claim 25.

10 DESCRIPTION OF THE PRIOR ART

A prior art milking machine of this kind is operated by
applying suction to the teats of a milking animal in order to
extract the milk and transport it over a suction hose to a
milk tank. The teats must be relieved periodically from the
15 sucking effect since continuous suction applied to the teats
causes the accumulation of blood and lymph in the teat tips
which restricts the milk canal, obstructs the milk flow and
weakens the barrier against penetration of udder pathogens,
and as a result thereof, causes udder health problems.

20

This problem has been eliminated through regular interruption
of the sucking effect by the provision of a pulsator and a two
chamber teatcup, for massaging the teats, whereby is obtained
drastic reduction of the damaging effect of permanent exposure
25 to suction on the teats.

In order to promote the flow of milk to the milk tank, a
restricted aperture has been provided in the suction path, for
example in the suction hose close to the teatcup, or at the
30 bottom of the teatcup, whereby the suction is relieved at
occasions so as to promote milk flow in the suction hose.

There are, however, problems with this solution since dirt, insects etc. might at least partly plug the aperture, thereby restricting the inflow of air through the aperture and subsequently the desired milk flow. A serious problem with
5 plugged aperture is so called impact, resulting in risk of infections in the udder.

Varying over time of admitted air also causes milk flow measurement problems, since the flow gauge used in milking
10 machines of the present kind is sensitive to such variations.

Increasing the diameter of the aperture could result in safer flow and more accurate gauge operation, but results in unwanted high rates of air in the milk transport system, which
15 could result in too high Free Fatty Acid (FFA) values in the milk. Also greater apertures are by the way subject to contaminating dirt and plugging insects.

AIM AND IMPORTANT FEATURES OF THE INVENTION

20 It is an aim of this invention to provide a milking machine and a method of milking whereby the prior art problems are solved or at least reduced.

According to a first aspect of the invention this is obtained
25 by arranging a cleaning device, which provides a cleaning fluid flow for clearing the aperture from possible dirt, insects etc. between milking sequences.

Hereby it is achieved that even a highly restricted aperture,
30 which is optimised with respect to desired air admission, normally in the region of 0,8 mm diameter, is freed from dirt and insects that might obstruct the airflow. An advantage is that hereby a predetermined airflow may be obtained, since it

is possible to optimize the diameter of the aperture with respect to air inlet. As a result more accurate milk flow measurement may be obtained since the operating conditions for a milk flow gauge, which is included in the system, are 5 stabilized. This is an important advantage provided by the first aspect of the invention.

It is preferred that the cleaning device applies a pressurised air jet against the aperture. This allows for having the 10 cleaning device positioned at a greater distance from the aperture, whereby variations with respect to positioning is more tolerable.

By instead applying a suction cleaning effect to the aperture, 15 the advantage is obtained that possible dirt is removed from the area of the aperture and collected by the suction nozzle, and that the risk of spreading dirt is reduced.

It is preferred that the cleaning device is placed on the 20 support structure which supports the teatcups in the rest position. This provides possibility of simple and secure installation of the cleaning device and accurate mutual positioning of the aperture with respect to the cleaning device.

25

It is also possible to provide for rinsing water to penetrate the aperture in order to clear it from dirt etc. Preferably this is obtained during the ordinary back-flush rinsing between milking sequences, whereby no additional equipment has 30 to be installed. It is only important to ensure that no rinsing water remains in the suction path after the flushing operation, and this may be obtained by using a valve, which obstructs the suction hose during rinsing so that rinsing

water is not allowed to enter chosen portions of the suction hose. It is, however, also possible to allow rinsing water to penetrate deeper into the suction hose, and in that case remaining rinsing water may be allowed to bee drained away
5 through a draining means positioned at a low point of the suction hose.

By arranging the aperture widening in the direction of the cleaning flow, efficient clearing of the aperture is obtained.
10

According to a second aspect of the invention, the problems of the prior art are solved by providing gas supply to the aperture for supplying pressurised gas into the region including the suction hose close to the teatcup and the
15 adjacent part of the teatcup.

This solution provides several advantages. Firstly, the plugging due to dirt or insects is completely eliminated. Secondly it has been made possible to supply gas having chosen
20 properties in order not to contaminate the milk.

It is preferred that the gas supply is controlled through a pressure regulator, which allows the farmer to adjust the gas supply as desired. For example, high FFA-value may call for
25 restricted gas supply.

In particular it is preferred that the gas supply is cut off when the pressure prevailing in the region in question is at a maximum. This way the gas supply pressure will not add to the
30 pressure pulse from the teatcup initiated by the pulsator. Instead this arrangement reduces unwanted pressure fluctuations, which otherwise could go beyond prescribed allowed variations at a certain milk flow.

Through both aspects of the invention the vacuum variations are reduced whereby regulations are more easily fulfilled. Further, in order to reduce vacuum variations, the volume of the lower part of the teatcup has in certain embodiments been 5 given an added, relatively large volume. Both aspects of the invention allows reduction of said volume or even the elimination of it, thereby reducing occupied space and costs.

An important advantage of the second aspect of the invention 10 is that a predetermined airflow may be obtained, since it is possible to optimize the flow parameters. Hereby more accurate milk flow measurement may be obtained since the operating conditions for a milk flow gauge included in the system are stabilized. This is an important advantage provided also by 15 the second aspect of the invention.

Further advantages are obtained through further aspects of the invention.

20 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in greater detail by way of examples and with reference to the drawings, wherein:

Fig. 1 shows diagrammatically a teatcup in its rest position 25 on a support structure provided with a cleaning device according to the invention,

Fig. 2 shows a detail of a first alternative cleaning device according to the invention,

30 Fig. 3a shows diagrammatically a second alternative cleaning device,

Fig 3b shows diagrammatically a further alternative cleaning device,

Fig. 4 shows a section of a means defining an aperture,

5

Fig. 5 shows diagrammatically an embodiment according to the second aspect of the invention, and

Fig. 6 shows a section of a detail of the embodiment in Fig.

10 5.

DESCRIPTION OF EMBODIMENTS

In the drawings like elements are denoted the same reference signs.

15

In Fig. 1 reference numeral 1 generally indicates a support structure for a teatcup in its rest position between milking sequences. In this situation the teatcup 2 rests hanging upside down between supporting elements and with a suction hose 3 and a pulsator hose 4 extending along each other, substantially vertically upwards. At a short distance from the teatcup 2, a connector means 5 is installed including through channels (indicated with interrupted lines) for each of the hoses 3, 4 and connecting nipples extending upwardly and downwardly (likewise indicated with interrupted lines). The connector means 5 is provided with a through aperture 6, which allows air from the outside to be sucked into the suction hose 3.

30 Further, the support structure 1 supports a nozzle 7 for directing a pressurised air jet in the direction of the aperture 6. The pressurised air supplied to the nozzle 7 is preferably an intermittent flow and for example such that air

is blown immediately after one milking sequence and immediately before the following milking sequence. This because of the possibility of removing "soft" dirt before it has dried and hardened, and in order, as late as possible, to 5 remove possible insects or dirt, which might potentially plug the aperture 6, and has reached the aperture during the resting period. The air jet emanating from the nozzle 7 is indicated with 8.

10 In Fig. 2 the cleaning device comprises a suction nozzle 9, which is positioned such that there is a relatively short distance between the aperture 6 and the suction nozzle 9 during the resting period for the corresponding teatcup. Suction applied to the suction nozzle 9 may be controlled 15 similarly to what has been said above with respect to the pressurised air nozzle in Fig. 1.

A second alternative with respect to a cleaning device for 20 cleaning the aperture is shown in Fig. 3a, whereby a rinsing device is indicated with 10. This rinsing device is preferably the ordinary back-flush rinsing device intended to periodically back-flush and rinse the teatcup between milking sequences. By providing a rinsing water pressure of a chosen magnitude and by assuring that there is a counter pressure 25 prevailing in the suction hose, a flushing effect through a back flush nozzle 11 will occur through the aperture 6, effectively removing dirt or insects. 13 indicates a means, such as a valve, for preventing back-flush water to flow further towards the milk tank (not shown here) in the suction 30 hose. Possible water having reached this position is preferably drained off through a channel (not shown) in this region.

A further alternative with respect to a cleaning device for cleaning the aperture is shown in Fig. 3b. This cleaning device is preferably the ordinary back-flush rinsing device which in this case is equipped with means for subjecting the suction hose to a pressurised gas. By providing a pressure of a chosen magnitude and by assuring an at least essentially tight seal in the suction hose, a cleaning effect will occur through the aperture 6, for removing dirt or insects. This is obtained by gas introduced through the back flush or rinsing nozzle 11. In detail, an air pressure supply is connected at 30 to the rinse water hose. 31 denotes a one way valve for preventing air from escaping in the wrong direction of the rinsing hose. The suction hose 3 is provided with a shut off valve 32 for maintaining tightness in the region of the teatcup. Preferably the shut off valve 32 is pressure controlled through tube 33, which is connected to the suction hose 3 upstream the shut off valve 32. When the teatcup is placed on the back flush nozzle 11 the cleaning sequence may be initialised through automatic means (not shown) triggering air supply through tubes at 30 and 33. The latter supply closes shut off valve 32.

Cleaning by pressurising the suction hose may also be achieved otherwise, even if the embodiment according to fig 3b is preferred in this respect. As an example, air pressure may be applied by an arrangement (not shown) separate from the rinsing equipment.

One advantage with the aspect of providing air or gas pressure inside the suction hose is that it is possible to provide clean and controlled gas, which will remain in the suction hose between milking operations.

Fig 4 shows an insert 14 in a wall portion 15 of a connector means, an enlargement of a teatcup or the like. The insert 14 is intended to be permanently fastened in a through hole in the wall so as to define an aperture 16 having in this case a 5 widening cross section along, here, a conical inner surface 17. The cleaning fluid is intended to flow in the direction to the left, arrow F, for efficient cleaning effect. Also other appearances of the aperture are of course possible.

10 The first aspect of the invention may be subject to modifications without departing from the scope of protection. For example, the cleaning device may be arranged otherwise and for other positions of an aperture similar to the shown aperture. For example, the aperture and the corresponding 15 cleaning device may be positioned with respect to a common claw included in a cluster type construction including plural teatcups.

Figs 5 and 6 show an embodiment according to the second aspect 20 of the invention. In this case air under pressure is supplied to the aperture 23 through a thin tube 18 which is drawn inside the pulsator hose 4. The tube 18 is thus connected to the aperture 23 in the suction hose 3 at its first end. At 24 the tube is lead out from the pulsator hose and is connected 25 to a pressure regulator which preferably is adjustable so as to allow the farmer to precision control, for example with a knob 21, the amount of air admitted into the region of the aperture 23 of the suction hose and the teatcup. The provision of the regulator 20 allows the operator to adjust the air supply if for example too high vacuum fluctuations in the suction hose have been observed or/and if the FFA-value is 30 elevated. The latter may depend on too much air in the system.

The pressure regulator is fed over a pipe 22 from a (not shown) air pump which may provide an air pressure of, as an example, 6 bar.

5 It is also possible to control the air supply such that it is minimised or cut off when the pressure prevailing in the suction hose has reached its peak (minimal negative pressure) due to the pulsator operation, and thus essentially only supplies air when the said pressure is low (more negative 10 pressure). This way the pressure of the supplied air will not add to the pressure fluctuations, instead it will diminish them in an advantageous way.

15 It is not excluded that the pressure regulator, in stead of being manually operable, is controlled by means of an automatic control system which accounts for pulsator operation, pressure prevailing inside hose 4 etc. and sends signals to the regulator as a response to sensed conditions. Preferably such an automatic system is computer controlled.

20 The aspect according to figs 5 and 6 makes it possible to supply clean air, as an example filtered outside air, or gas having a chosen composition. This way it is avoided that undesired gases, such as ammonia, generally being present 25 inside the stable building, enters the system.

The second aspect of the invention may be subject to modifications without departing from the scope of protection. For example, the tube 18 may be drawn outside the pulsator 30 hose and extend therealong. Also other ways of placing a conduit separately, outside the pulsator hose, for supplying gas to aperture 23 are possible. The entry of the tube 18 into the suction hose may also be arranged otherwise. Corresponding

to the case with respect to the first aspect of the invention, the aperture and the corresponding device for supply of gas may be positioned with respect to a common claw included in a cluster type construction including plural teatcups.

Claims:

1. Milking machine including a milk tank (25), a pulsator (26) and at least one teatcup (2) which is connected over a suction hose (3) to a suction pump (28), wherein at least one aperture (6) is arranged in the suction path for admitting outside air into the region of the interface between the teatcup (2) and the suction hose (3), **characterized in** that a cleaning device (7;9;10) is arranged to provide fluid flow for cleaning the aperture (6) from dirt etc. between milking sequences.
2. Milking machine according to claim 1, **characterized in** that the cleaning device includes at least one nozzle (7) which is arranged to direct a pressurized air jet (8) against the aperture (6).
3. Milking machine according to claim 1, **characterized in** that the cleaning device includes at least one nozzle (9) which is arranged to apply a suction effect to the region of the aperture (6).
4. Milking machine according to any of the claims 1 - 3, **characterized in** that the cleaning device (7;9) is placed on a support structure (1) which supports and positions each teatcup (2) and the neighbouring part of the suction hose (3) in a rest position between milking sequences for providing the cleaning action in said rest position.
- 30 5. Milking machine according to claim 1, **characterized in** that the cleaning device includes at least one rinsing nozzle (10) for rinsing water to be applied into the teatcup (2) and subsequently produce a flow (12) through the aperture (6).

6. Milking machine according to claim 5, characterized in that the cleaning device includes means (13) for preventing rinsing water to be sucked into the milk tank (25).

5 7. Milking machine according to claim 6, characterized in that said means (13) includes a valve.

8. Milking machine according to claim 6, characterized in that said means (13) includes draining means.

10 9. Milking machine according to any of the claims 1 - 8, characterized in that the aperture (6;16) widens in the direction of the cleaning flow.

15 10. Milking machine according to claim 1, characterized in that the cleaning device includes a gas pressure supply (30) being connectable to the suction hose (3) in order to produce an over-pressure therein and thereby a gas flow through the aperture (6).

20 11. Milking machine according to claim 10, characterized in that the gas pressure supply (30) is associated with a rinsing nozzle (11).

25 12. Method for milking using a milking machine including a milk tank (25), a pulsator (26) and at least one teatcup (2) which is connected over a suction hose (3) to a suction pump (28), wherein outside air is admitted into a region of the interface between the teatcup (2) and the suction hose (3),
30 characterized in that a fluid flow is provided for cleaning the aperture (6) from dirt etc. between milking sequences.

13. Method according to claim 12, **characterized in** that a pressurized air jet (8) is directed against the aperture (6).

14. Method according to claim 12, **characterized in** that a
5 suction effect (9) is applied to the region of the aperture
(6).

15. Method according to claim 12, **characterized in** that
rinsing water is applied into the teatcup so as to
10 subsequently produce a flow through the aperture.

16. Method according to any of the claims 12 - 15,
characterized in that the cleaning effect is applied when each
teatcup (2) and the neighbouring part of the suction hose (3)
15 is in a rest position between milking sequences.

17. Method according to claim 12, **characterized in** that gas
under pressure is supplied (30) to the suction hose (3) in
order to produce an over-pressure therein and thereby a gas
20 flow through the aperture (6).

18. Method according to claim 17, **characterized in** that gas
pressure is supplied (30) through a rinsing nozzle (11).

25 19. Milking machine including a milk tank (25), a pulsator
(26) and at least one teatcup (2) which is connected over a
suction hose (3) to a suction pump (28), wherein at least one
aperture (6) is arranged in the suction path for admitting a
gas into a region of the interface between the teatcup (2) and
30 the suction hose (3), **characterized in** that a gas supply
conduit (18) is connected to the aperture (6) for supplying
pressurized gas into said region during the milking sequences.

20. Milking machine according to claim 19, characterized in that a pressure regulator (20) is arranged to control the gas supply.
- 5 21. Milking machine according to claim 19 or 20, characterized in that the pressure regulator (20) is arranged to cut off the gas supply when the pressure prevailing in said region is at a maximum.
- 10 22. Milking machine according to any of the claims 19 - 21, characterized in that the gas supply conduit (18) is arranged inside a pulsator conduit (4).
- 15 23. Milking machine according to any of the claims 19 - 22, characterized in that the gas supply conduit (18) is extending along a pulsator conduit (18) and the suction hose (3).
- 20 24. Milking machine according to any of the claims 19 - 23, characterized in that the gas supply conduit is connected to an air filtering unit.
- 25 25. Method of milking using a milking machine including a milk tank (25), a pulsator (26) and at least one teatcup (2) which is connected over a suction hose (3) to a suction pump (28), wherein gas is admitted into a region of the interface between the teatcup (2) and the suction hose (3), characterized in that pressurized gas is supplied into said region during the milking sequences.
- 30 26. Method according to claim 25, characterized in that the gas supply is controlled by a pressure regulator (20).

27. Method according to claim 25 or 26, characterized in that the pressure regulator (20) cuts off the gas supply when the pressure prevailing in said region is at a maximum.

5 28. Method according to any of the claims 25 - 28, characterized in that the gas supplied is clean filtered outside air.

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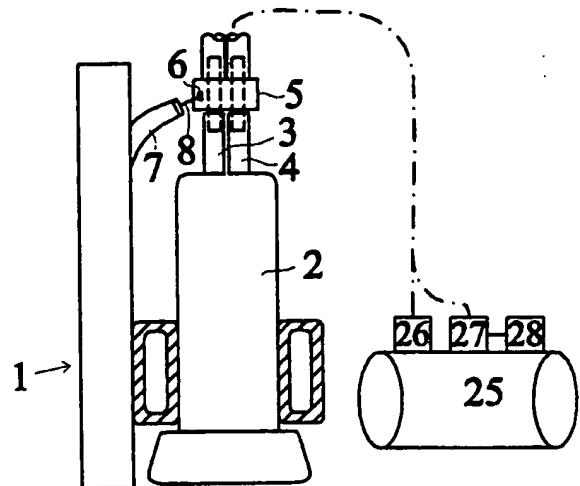


Fig. 1

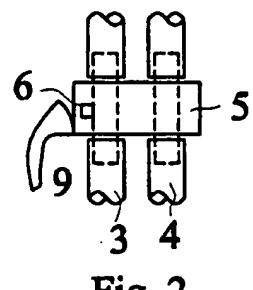


Fig. 2

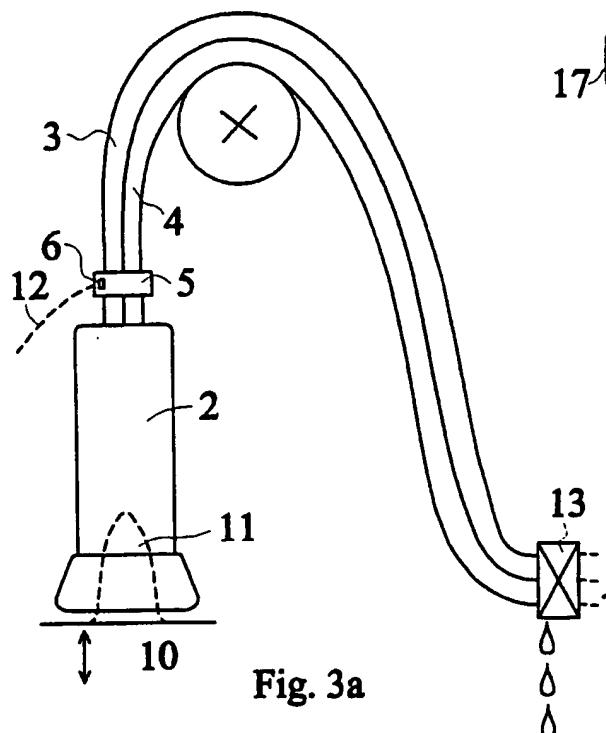


Fig. 3a

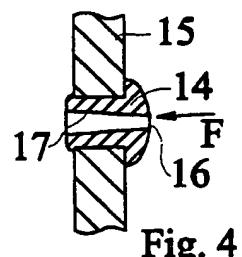


Fig. 4

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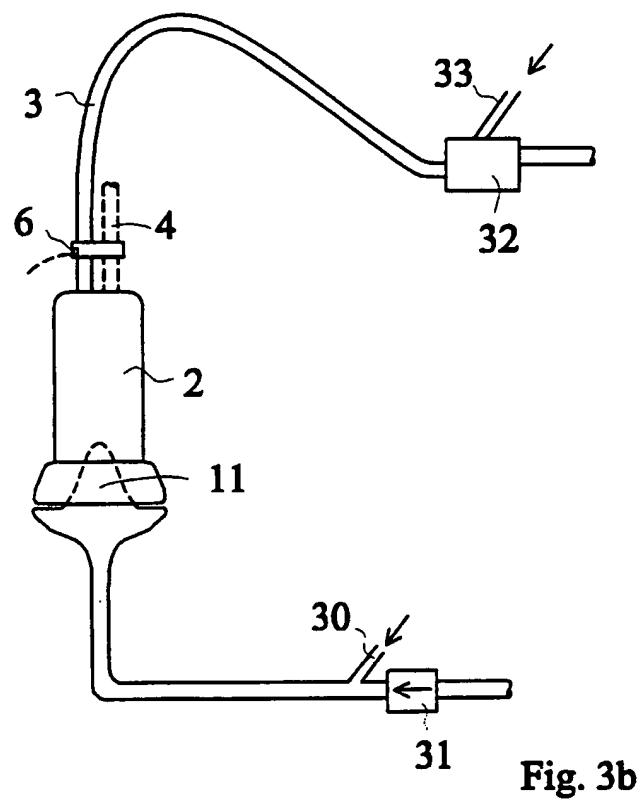


Fig. 3b

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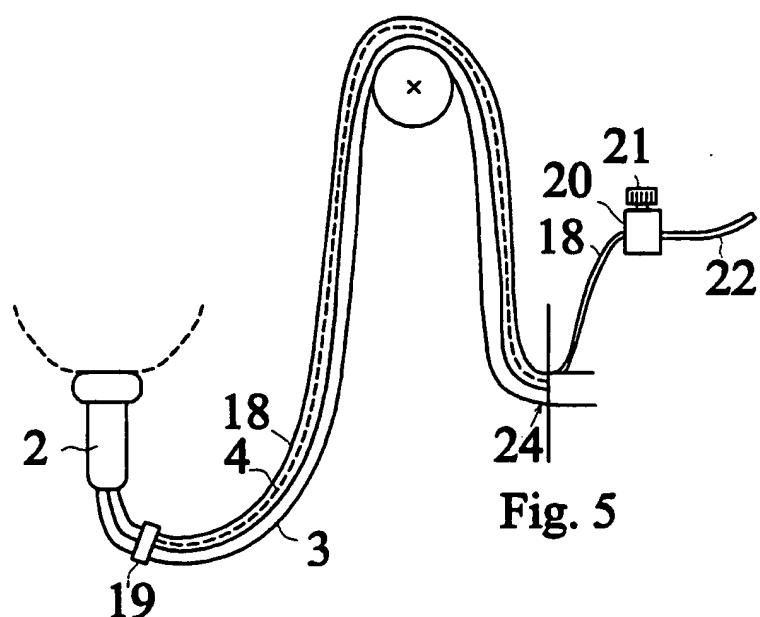


Fig. 5

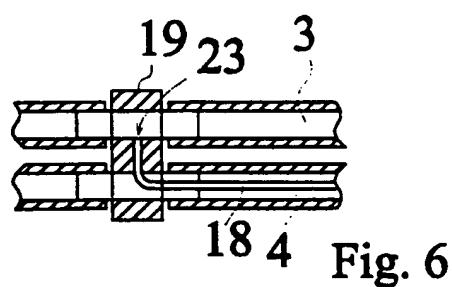


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01768

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A01J 7/02, A01J 5/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 4432754 C2 (LAUB-MAIER,MARIA), 28 March 1996 (28.03.96), column 4, line 24 - line 27; column 6, line 23 - line 30 --	1,4-7,12,15, 16
X	WO 9617509 A1 (MAASLAND N.V), 13 June 1996 (13.06.96), page 6, line 16 - line 22; page 7, line 12 - line 24, figures 1,3, claims 8-12 --	19,20,23-26, 28
X	WO 9828969 A1 (PROLION B.V), 9 July 1998 (09.07.98), figure 2a, claims 1,8 -----	19,20,23,25, 26

 Further documents are listed in the continuation of Box C. See patent family annex.

- * Special categories of cited documents
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 December 2000	22-12-2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Magnus Thorén Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORTInternational application No.
SE00/01768**Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1 - 18 refer to: A milking machine with a cleaning device for an aperture arranged in the suction path, and a method for this cleaning
2. Claims 19 - 28 refer to: A milking machine with a suction hose connected to an aperture arranged in the suction path, and a method of supplying pressurised gas to the suction hose.

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
 No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.	
PCT/SE 00/01768	

Patent document cited in search report	Publication date		Patent family member(s)		Publication date
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